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the best authorities with him, take a middle course, opposed alike to the eccentric teachings of Knox, and to the quiet ignoring of the importance of race in history, so fatal to Buckle's learned and eloquent, yet inconclusive, essay.

Our author follows some notable former writers on the subject, in arguing from an analogy between the elements and compounds in chymistry, on the one hand, and the pure and mixed races of animals, man included, on the other. The argument is very ably sustained, and it tells favourably on the Darwinian theory, although Dr. Bastian is by no means a mere advocate of that theory, or any other; all facts, whether apparently adverse or favourable, being fully brought forward and impartially considered. Towards the latter part of the book great prominence is given to archæological, mythological, and linguistic inquiries, showing an astounding amount of reading, as well as original research and travel. The information on those points is very complete, and we approach thereby the question of race from another road that may yet open up vistas hitherto little thought of. The light, which by recent investigations is shed on the intercourse between the Icelandic discoveries of Finland and the aborigines of Northern and Central America, is likely to demolish many theories boldly advanced, many notions still tenaciously defended about the Aztecs, Mexican architecture, inscriptions, etc., etc. We recommend this part of the book to the students of comparative Mythology and Philology; they will find in it more than they look for.

A map, which is drawn up with the assistance of Professor Kiepert, forms a very valuable and welcome addition to this little volume. It shows, in varying colours, the areas occupied towards the end of the fifteenth century by different races and nationalities of the world; a reproduction of this map on an enlarged scale is a desideratum for all Anthropologists, who are often in want of such a guide on a complicated and difficult subject.

ON THE LOCALISATION OF THE FUNCTIONS OF THE BRAIN, WITH SPECIAL REFERENCE TO THE FACULTY OF LANGUAGE.

By James Hunt, Ph.D., F.S.A.

(*Historical part continued from* p. 345, vol. vi.)

Among the writers of the sixteenth century we meet with an anthropologist, who deserves even more space in these pages than we can here afford him. We allude to Juan Huarte, the author of that remarkable work entitled *An Examination of Geniuses for the Sciences, showing the difference of aptitudes among men, and what sort of learning would suit best each genius.*[*]

Huarte certainly was not a scientific anatomist, in the present acceptation of the term; but he was a man of great erudition, an original and bold thinker, a keen observer, and not merely a speculative but a practical philosopher. It is not our intention to give here a complete analysis of the work in question; we shall merely give such extracts as will show that Huarte was one of the first who forcibly pointed out the intimate connexion of mental phenomena and the body, and boldly and distinctly proclaimed the brain to be the organ of thought. When we take into consideration the century and the country in which Huarte wrote, we marvel at the boldness of the man who, with the eyes of the Spanish Inquisition upon him, dared to evolve even the character of Christ from the spurious description of his physical organisation, attributed to P. Lentulus, the proconsul of Jerusalem. To show at once "what manner of man" we have before us, we extract from the work a passage on authors and scholars, whom the author compares to sheep and goats, evidently ranging himself among the latter.

"The goat does not like the plain, but prefers rocks and hills, which it climbs, and looks down into the abyss; it leaves the herd and the trodden path. The rational soul, dwelling in a well-organised and tempered brain, possesses the same qualities; it proceeds onward to discover new things. On the other hand, there are people who do not imagine that there is anything more to be discovered in the world. They have the character of sheep, which never leave the herd nor the trodden path. Amongst scholars, some are bold, and care little about received opinions; they do everything in their own way, speak their thoughts freely, and are their own guides. The others are timid, humble; they swear by the words of some great authorities; they follow them, and deem their opinions as incontrovertible truths, which alone deserve faith; whilst they hold what others say to be whims and lies. These two kinds of geniuses are, taken together, very useful. For as shepherds generally put to a great flock of sheep about a dozen goats, to render the former lively, and show them the way to new pastures; so must there be, in human sciences, some inventive minds, which show to the sheep new wonders of the creation. It is in this way that science is developed, and in this way the knowledge of man increases daily."

One of the leading ideas, which pervades the whole work, is that man is just what nature made him; that, therefore, we must study the nature of each man to learn what he is fit for. If you send a brute to Rome, a brute will return; or as he has it, *Quien bestia va á Roma bestia torna*": "it will as little avail him to go to Salamanca, if he brings no intellect with him". Huarte, therefore, in his dedication to the king of Spain, proposes,—

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[*] "Examen de ingenios para la Sciencias, donde se muestra la differencia de habilidades que hay en hombres y el genero de letras que à cada uno responde en particular." Pampluna, 1578.

> "That the universities should examine whether those who present themselves to study logic, philosophy, divinity, law, etc., possess the requisite aptitudes for either of these sciences; otherwise, apart from the injury that such a one may afterwards do to the commonwealth by practising an art wherein he is not skilled, it is melancholy to see a man take pains and rack his brains about a matter whereof he cannot reap any advantage."

Another leading idea is that the mental operations of man depend on the condition of his corporeal frame. "It is," as he observes, "against all natural philosophy, to believe that the rational soul, being in the body, can operate without the mediation of her corporeal instrument." He rejects the theory of ancient philosophers, that the heart is the chief seat of the soul. "It is true," he adds, "that in many passages of the sacred scriptures, the heart is styled the superior part of man; but this is merely an accommodation to the way of speaking in use at the time. Experience and reason have proved that the brain, and not the heart, is the chief seat of the rational soul." In accordance with this opinion, he observes:—

> "When God formed Adam and Eve, it is certain that before he filled them with wisdom, he instrumentalised their brain in such a manner that they might receive it with ease, and serve as a proper instrument, therewith to be able to discourse and to reason."

Although Eve was made by God as perfect as any of her sex can be, yet is it an undoubted fact that woman is inferior in intellect to man. The cause evidently is that the composition and temper of her brain are differently disposed.

In chapter I, he proves, by an example, that if a child have not the disposition which is requisite for a certain science, the best schoolmaster will lose his labour. We almost fancy we read the biography of Gall in the following passage:—

> "I am myself a good witness to this truth. There were three companions of us, who entered together to study Latin. One of us learned it with great facility, the rest could never make any commendable composition; but passing on to logic, the one who could not learn grammar, excelled in that art. Then all three coming to hear astronomy, it was a matter worthy of note, that he who could learn neither logic nor grammar knew, in a few days, more astronomy than the master who taught him. I then greatly marvelled thereat, and found that every science required a special and particular aptitude."

Assuming thus that nature alone makes man able to learn, he inquires (chap. iii):—

> "What part of the body ought to be well tempered, that a young man may have ability. No one doubts," he says, "that the brain is the instrument ordained by nature to the end that man might become wise and skilful. Four conditions ought the brain to enjoy, that the rational soul may perform the works which appertain to understanding and wisdom. 1. Good composition; 2. that the parts be well conjoined; 3. that the heat exceed not the cold, nor the moist the dry; 4. that this substance be made of parts subtile and delicate. The brain should be well formed, and of sufficient quantity. The four ventricles should be distinct and severed, each in its proper place, and of appropriate capacity."
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> "Galen," he continues, "infers the good figure of the brain from the outward shape of the head, which," he says, "ought to be such as it would be when we take a round ball of wax and compress it a little on the sides. The forehead and occiput will then present projections. Hence, it follows that the man who has his forehead very plain, and the back of his head very flat, has not his brain so figured as is requisite for wit and ability."

Speaking of the quantity of brain, he observes: that none of the brutes have as much brain as man; and that animals approaching man in wisdom and discretion (dog, ape, fox), have a greater quantity of brain than other animals with larger bodies. Galen says, that a little head in a man is ever faulty, because it is deficient in brain. This, says Huarte, is not always the case. A big head affords no positive proof of a large brain, as the size may be owing to the thickness of the bones and the quantity of flesh; in the same way as we find big oranges with such hard and thick skins, that they contain but little juice.

The soul, in order to produce different effects, must act by special instruments. This is shown by the different structure of the external organs of sense; we may hence conclude as to the internal senses. If, then, it be true, that every kind of work requires a special instrument, it necessarily follows that within the brain there must be one organ for the understanding, one for the imagination, and another, different from them, for memory; for if all the brain were organised after the same manner, either the whole would be memory, or the whole understanding, or the whole imagination. But we see that these are very different operations, and therefore it is clear that there must be a variety of instruments.

But, when we open the skull, we shall find the whole composed of the same substance, only there appear four little cavities. Galen and other anatomists have endeavoured to find out the truth, but none of them have precisely stated the function of either of these ventricles. They only affirm that they are workshops (which some doubt) where the vital spirits are digested and converted into animal spirits, to give sensation and motion to other parts of the body.

Huarte dissents from this theory, and thinks that the fourth ventricle alone has the office of digesting and altering the vital spirits; for which reason nature has severed it, and placed it at a distance from the others, and made that part of the brain a separate portion.

He doubts not that the three ventricles placed in the forepart are intended by nature to no other end than to discourse and philosophise, which is apparently proved by the fact that in severe study and contemplation it is always this part of the head that is aggrieved.

But the difficulty is to know in which of these ventricles is seated memory, or imagination, or understanding. He comes to the conclusion that, in as much as the understanding cannot act without memory, nor memory without imagination, all these powers reside in each ventricle. But, if so, it may be asked to what end has nature made several ventricles, as one would suffice for the performance of all. He answers, for the same reason that nature has made two eyes, and two ears, so that when one fails the other may act. Thus, in palsy, the action of one ventricle may be lost, and yet memory, understanding, and imagination, though weaker than before, may remain, which clearly shows that these faculties reside in each ventricle.

In chapter iv he shows that when the brain becomes heated, a man may become eloquent and wise. Among other cases he cites that of a rude country fellow, who, becoming frantic, made a very eloquent discourse in his presence, with so many flowers of rhetoric, and such apt choice of words, as if Cicero had spoken in the presence of the Senate. This person, when in health, had nothing to say.

But this, he adds, is nothing compared to the case of a page in the service of a grandee, who, whilst he was mad, delivered such rare conceits, and devised such excellent modes of governing the kingdom, of which he imagined himself to be the sovereign, that his master rarely left his bed, and prayed God not to restore him to health. It seems, however, that the page was cured by a physician, who, when he claimed his fees from the master, received the following answer: "I was never more aggrieved; of one who was wise and well advised you have made a fool again." Nor did the good doctor fare better when he applied to his former patient, who also deplored that he had been cured.*

On the intellectual faculties Huarte observes as follows: Memory and understanding are faculties essentially different. Memory is only a passive faculty, depending on certain qualities of the brain, such as moisture and softness, which render the brain fit to receive what the imagination, by means of the senses, has perceived. Memory is to the imagination what white paper is to the writer. What is contemplated by the imagination with attention, is deeply impressed upon the memory, what is only superficially viewed is easily forgotten. In the same way as a writer, who carefully delineates his letters, renders his writing legible, so the imagination, in order that each image should long and legibly remain in the brain, must carefully impress it in the brain, otherwise, the image will be scarcely perceptible; as happens in old manuscripts, in which some parts are obliterated by time, and others are distinct. In the same way, some images may remain in the memory, whilst others are effaced. Memory and understanding are not merely different, but opposed faculties. The understanding requires a dry brain, the memory a soft and moist brain. Young persons have a good memory on account of the softness and moisture of their brain. In old age the brain substance becomes so hard as to be incapable of receiving impression. Hence young people are deficient in understanding, in which old persons excel, for the understanding requires a dry brain. Women, like children, having softer brains, are inferior in understanding to man. He even goes so far as to assert that men possessing a prodigious memory, are deficient in understanding, and *vice versa.* There is also in this work a curious chapter on the mode of begetting strong, wise, and virtuous children, male or female, which we do not think it necessary to touch upon.*

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* This anecdote has given rise to a ludicrous mistake on the part of D. Seligman. In his *Sciagraphia Virium Imaginationis*, he writes, Huartus, Hispanus, se regem in delirio arbitratus prudentissimos de regimine faciebat discursus: Huartus is thus considered to have been mad himself, whilst he only cites the above case. Willis (see *infra*) also quotes the case incorrectly.

Huarte's work naturally provoked much criticism. To those of his contemporaries, who complained that they had in vain sought in his book for the chapter which was to reveal to them their aptitudes, he simply replied, that he was not obliged to give wit to those to whom

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* Juan de dios Huarte, Navarro, was, as he tells us himself (natural de San Juan de pie del Puerto) born about 1525, at St. Jean-Pied de Port, a little town in Navarre, then belonging to Spain. Nothing certain is known about the year of his death. He studied medicine at Huesca, in Aragonia, then a flourishing university; he probably, also, attended lectures at Salamanca and Alcala. He then seems to have settled at Huesca, where he died, about the end of the sixteenth century. Some say that he died in Madrid. Huarte appears to have finished his work in 1557, but only published it in 1575. The earliest edition we have seen is that of 1578. The work soon created a great sensation in the literary and scientific world, and was translated into most European languages. In Germany it became known by the name *Scrutinium Ingeniorum,* a Latin translation, by Æschasius Major (Joachim Cæsar), Leipzig, 1612. In English, there are two translations, one by Carew, *The Examination of Men's Wits,* etc., London, 1616, and another by Bellamy, *The Tryal of Wits,* etc., 1698. Several translations appeared in France. The earliest translation we know of is that by Camilli, Venet., 1586, from which Carew made his translation. Finally, Lessing translated the work into German in 1752, and gave it the title *Prüfung der Köpfe* (an Examination of Heads).

God and nature refused it. There is, however, one critic we must mention who wrote a formal refutation of Huarte, in the shape of a book double the size of Huarte's work. This book is entitled, *An Examination of the Examination of Geniuses*, by Jourdain Guibelet, physician to the King. It is not our purpose to enter into the merits of this refutation. Certain it is that Guibelet is far inferior to Huarte in originality of thoughts, and power of expression. He belongs, in fact, to the second class of authors described by Huarte. Guibelet is now almost entirely forgotten; his name being scarcely mentioned in any biographical dictionary, nor his book cited in bibliographical works. It is for this very reason that we would rescue from entire oblivion one chapter, at least, of this scarce work, partly because we think it deserves preservation from its intrinsic interest, and partly because it forms what the author intended it should, a supplement to Huarte. The following is the substance of the last chapter of Guibelet's work,* headed, *By what Signs the Character of Children may be known.* This ought to have been the main object of Huarte's book, but, as he has neglected it, or has only slightly touched upon it, Guibelet says, that he would try to give a few rules on account of the importance of the subject.

There is such intimate connection between the soul and its organ the body, that we are able to judge of the mental capacity of children by their face, which has been called the mirror of the soul, and by other parts of the body, when the children are about seven or eight years old. The chief marks, touching the minds of children, are to be found about the head. As the brain is the seat of the faculties, it is reasonable to suppose that *the external head should show what is going on within*, just as the dial outwardly represents what is hidden. We must, therefore, first examine this part and see whether the child has a well formed head. . . . . The head should show some eminence in front and behind; because of the ventricles of the brain, in which are seated the sensus communis, imagination, and memory. The top of the head should be slightly depressed in the region of the sutures. . . . . The hair should be smooth, neither too stiff, nor too black; the face should be rather thin, neither too fleshy, nor too fat; the complexion should be a mixture of white and red. He then proceeds to the conformation of the eyes, "the two windows of the soul," as he calls them. They should be neither too large nor too small, nor too deep seated; they should be bright. The chief characters of a sound mind, he continues, are clearly marked in the face between the eyes, which shine like brilliant stars; the eyes should be azure or sky-coloured.

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* *Examen de l'Examen des Esprits.* Par Jourdain Guibelet, M.D., Médecin du Roy à Evreux. Paris, 1631.

The space between the eyes should be a little depressed, rather than raised ; Straton thought that there was the seat of the soul. The forehead and the hand are two parts of the body in which are depicted all the powers of the mind. A large and square head, proportioned to the size of the face, shows the force of the faculties, it is a mark of a large brain, and a sign of good sense, and a sound mind.

God has put some marks in the hand, so that each may know what he can do. But all this is not for children, but for grown up men who have a face lean from study, *vultum exercitatum*, as Petronius says, and hands skilled for all kind of work. Guibelet very judiciously adds, it is also from the actions and deportment of children that we can conjecture what they will be. Those who think slowly, but still show vivacity of mind when something interests them, are generally intelligent. This tardiness, age and study will remove, and they will then show what is now hidden. There are some children with vivid minds, ready to say everything, and to do everything. They cause pleasure to the parents, but it is a straw-fire which soon becomes extinct.

It is noteworthy what Fracastor says, that those who have great memory for localities and roads, approach the nature of brutes. The teacher may also by frequently questioning his pupils judge of the state of their intellect.

Michael Servetus, of Villanuova, in Arragonia, born 1509, the discoverer of the circulation of the blood through the lungs, burnt at Geneva as an heretic in 1553, at the instigation of Calvin, must also be mentioned as a localiser of the cerebral functions. He believed that the choroid plexus was the organ destined to secrete the animal spirits ; that the true seat of the soul was in the aqueduct of Sylvius ; that the two anterior ventricles were destined to receive the images of external objects, and that the fourth ventricle was the seat of memory.*

As will be seen, there is scarcely any part of the encephalon which has not alternately been looked upon as the palace of the soul; none, however, has acquired such a celebrity as the pineal gland, the spot selected by the great reformer of Philosophy, the opponent of Aristotle, namely, Renatus Cartesius (René Descartes, born 1596, died 1650). The chief reasons Descartes gives for assuming that the *glandula pinealis* is the seat of the soul, are the following.† Although the soul is immanent in the whole body, there must be a certain part in which it more specially exercises its functions. This part is not the whole brain, but the pineal gland, which is situated in the middle of the cerebral substance, above the canal through which the spirits of the anterior ventricles communicate with the spirits of the posterior cavity, so that the slightest motion of that body may change the current of the spirits, whilst the slightest change in the spirits may affect the motions of the pineal glands. We need scarcely add, that the pineal gland is, at present, left entirely untenanted, as regards any intellectual function.

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* *Restitut. Christian.*, lib. v. Vienna, 1553.

† Descartes, *Passiones Animæ*. Amstel., 1664, art. 31, 32, 34.

Physiognomy and Cephalonomy are so intimately blended, that we must not pass over two authors of this period, the chief representatives of the above doctrines. The first we shall quote from is *Marian Cureau de la Chambre* (born 1594, died 1669), physician to Louis XIV, and one of the first members of the then newly founded French Academy. Tinged as the works of these writers are with baseless hypotheses, paradoxes, and astrological superstitions, they still deserve the attention of the Physio-anthropologist. The two chief works of de la Chambre are his treatises *On the Art of Knowing Men*,* and *The Character of the Passions*; he was also the author of numerous other works.

The subjoined extracts are from the chapters on the principles of Metoposcopie, in the work *On the Art of Knowing Men.* "The forehead is unquestionably that part of the face which Metoposcopy is most occupied with. The signs are there in great number, and more diversified than anywhere else; hence Metoposcopy derives its name from this spot. When we inspect this confined space, which naturally should be smooth and equal, and yet which presents such a variety of irregular lines, some of which vanish and give rise to others; when we find that some are deeper, others more superficial, some short, others long; that they are not to be found in the same number, or of the same colour alike in two persons; then, I say, that we have reason to believe that there is some secret hidden in man's forehead, unknown to man, and that the impressions upon his forehead are due to nobler and higher causes than the lines we find on the foreheads of animals. It might be said that the consistence of the skin is the cause of this diversity, and in proportion as it is thicker or more supple, the lines are more or less easily formed; but do we not see a vast number of persons whose skin is of the same consistence, yet who have not one line alike? He admits that movement and dryness may contribute to form these lines; but he contends that these lines on the forehead exist already at birth, although they are not then perceptible. We must then attribute the first impression of these lines to a cause outside the body, and as there are incontrovertible proofs that certain planets govern certain parts, so must we conclude that the lines on the forehead are of this order, and they are imprinted by one of these planets. In his opinion, it is probable that the forehead is governed only by one planet, namely, Saturn. We may only add that he considers the nose is governed by Venus, and the lips by Mercury.

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* *L'Art de connoistre les Hommes.* Paris, 1663. *Les Caractères des Passions,* 1658.

The normally greater strength of the right side of the body, a subject which will be again adverted to in the sequel, is thus accounted for by our author. The hands are the chief instruments used by the mind to perfect its inventions, and, no doubt, they give such an advantage to man, that if we cannot say with the ancient philosophers, that man is wise because he possesses hands, we may at least assert that he appears wise because of his hands. Nature has placed them as much as possible near the seat of reason, and the senses with which they are so nearly connected. The right hand is the first in dignity, being more agile and stronger than the left. It is stronger because it has more heat, and it has more heat, not merely because it is on the same side as the right ventricle of the heart, where the blood is hotter and more boiling; not merely because the liver, the source of blood, is nearer to it; not merely because the veins of the right side are, as Hippocrates says, more ample, but also because it is placed on the right side, where all movements should commence. That all movement commences naturally on the right side, is a truth which cannot be contested, when we observe what is going on in animals. Thus, quadrupeds always commence moving with the right forefoot; and bipeds also always put the right foot foremost. We carry burdens better on the left shoulder, so as to leave the movement of the right foot free.

The second, indeed the most prominent representative of Cephalonomy and Physiognomy of the seventeenth century, is an Englishman, namely, Richard Saunders, the very prototype of Gall and Lavater. Many of the axioms laid down in this singular and scarce work,* from which we take the subjoined extracts, will be found closely resembling the fundamental principles as laid down in modern phrenological works, as the following passages will abundantly show.

"Now, in our science of Physiognomie, the form, the proportion, and dimensions of the head are to be considered; for by it, and its form, we judge of the mind contained therein.

"A little head is never without vice, and most commonly, is guilty of little wisdom, but rather full of folly, which is naught and malicious.

"The best form of a head is moderate, as greatness and thickness, and of a decent and convenient roundness, which, before and behind, is tempered with a little depression. . . . .

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* *Physiognomie, Chiromancie, Metoscopie,* etc. By Richard Saunders, Student in the Divine and Celestial Sciences. London, 1653.

"The brain, one of the noblest parts of the body, is according to the form of the cranium; for if the cranium be corrupted, the brain is so too. The head of man has proportionately more brains than all other living creatures; and men have more brains than women; and the head of man has more joynts than any other creature. So the well-formed head is like a mallet, or sphear, there being some eminence before and behinde; the form of the middle ventricle should be a little compressed, so the cogitative faculty is the more notable. If the forepart be depressed, the man is of no judgment: if the hinder, he has no memory. . . . . When the head is big, proportionately to the body, the sinews of the neck big, and the neck itself strong, it is a sign of strength, choler, magnanimity, and a martial humour. . . . . A head having the middle ventricle somewhat compressed towards the side, denotes the cogitative faculty, natural diligently comprehensive, rationative, and eloquent, which proceeds from the union of the spirits that are in that place; those who have a head thus are learned and knowing. The head, very little, is necessarily an evil sign; and the less it is, the more folly there is."*

In chapter eight, which treats of Metoposcopy or the signification of the forehead, the author illustrates his views by fifty woodcuts of heads, in which the lines on the forehead and its form betray the disposition of the individual, "according to the most accurate and exact observation, which being as an epitomy of the whole doctrine, may delight the reader." Some lines denote the character of a simple honest person, others denote a murderer, a thief, a prattling loquacious person, cowardice or courage, meekness and impudence.

At this period general human anatomy was already comparatively in an advanced state; but the anatomy and physiology of the brain and nerves was still vague and meagre in the extreme. There can be no doubt that Thomas Willis occupied the foremost rank in the seventeenth century as a cephalotomist and neurologist. His great work "On the Anatomy of the Brain and the description and use of the Nerves,"† although published more than two centuries ago, forms still the foundation of modern neurology. Willis was the first who perceived the great advantage of comparing the human brain with the animal brain, and he arrives at the conclusion now generally admitted—that man's intellectual superiority was greatly owing to the depth and extent of the cerebral convolutions. He attached great importance to the grey substance as generating the force of which the medullary matter is the distributor. This is not the place to enter into his great merit of having introduced a new method or, at all events, a uniform method of dissecting the brain, which before him was performed downwards and upwards and in different directions; nor shall we say any thing about his tracing the origin of the cranial nerves, and their classification, by which he introduced order where till then the greatest confusion obtained. What concerns us here is this, that Willis considered not only the brain as the organ of the rational soul, as the origin and source of all conceptions, but that he assigned to different parts of the brain different physical and mental functions.

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* Part II, chap. vii, p. 158, *et seq.*

† *Cerebri Anatome; cui accessit nervorum descriptio.* London, 1664.

In his Preface to the Reader, after stating that he felt ashamed of having drawn out for himself and his auditors a kind of poetical philosophy and physics consisting of conjectures, he came to the determination not any longer to pin his facts on the received opinions of others, nor on the guesses of his own mind, but for the future to believe nature and ocular demonstration. He consequently, as he states, addicted himself specially to the opening of heads and to inquiring into the offices and uses of the brain and its nervous appendages. The first sentence of chapter i, "On the method of dissecting the brain" is characteristic; it runs thus: "Among the various parts of an animal body subject to anatomical inquisition, none is presumed to be easier and better known than the brain; and yet there is none less or more imperfectly understood." The importance which he attached to the comparative anatomy of the brain is shown in the following passage: "That the perfect knowledge of the brain may be gained, it is necessary not only to dissect men's heads but those of all other kinds of living creatures . . . . . In doing so I shall shew the communities and differences which the parts in question obtain in various animals, compared among themselves and with man. From such a comparative anatomy not only the faculties and uses of every organ, but the impressing influences and secret workings of the sensitive soul will be discovered."

Chap. x. *A description of the Brain and the use of its parts*:—"The brain is accounted the chief seat of the rational soul in man, and of the sensitive in brute beasts; it is the chief mover in the animal machine and the origin and fountain of all motions and conceptions. *Convolutions.*—In the more perfect animals all the turnings are made of a twofold substance, viz. cortical and medullary; the animal spirits are wholly, or for the most part, generated in the cortical substance, the medullary part serves for their dispensation. The anfractuous brain, like a plot of ground planted with nooks and corners and danks and molehills, has a far more ample extension than if its superficies were plain and smooth. These folds are larger and far more numerous in man than in any other living creature for the various and manifold actings of the superior faculties."

Willis rejects the theory of the ancients that the animal spirits are elaborated in the ventricles, or that the supreme seat of the soul is fixed there. He also rejects the theory that the pineal gland is the seat of the soul, or that its chief faculties arise from it, on the ground, "because animals which are almost destitute of the superior powers of the soul, have the glandula large and fair enough." (Chap. xiv; *Anat. of the Brain.*) The sensations he places in the corpora striata; these sensations are represented upon the corpus callosum, as it were upon a white wall, and so induce a perception and a certain imagination of the thing felt. These images, further progressing from the corpus callosum to the cortex and entering its folds, constitute the memory (chap. iv, *On the Soul of Brutes*). As regards motion, Willis considers that the cerebrum presides over voluntary, and the cerebellum over involuntary movements. In a chapter on stupidity Willis remarks:—"It is a common observation that wit and ingenuity depend somewhat on the magnitude and figure of the head, and consequently of the brain. The genuine and best figure of the head ought to be globular; those who have a flat head, or otherwise unproportionate, are for the most part affected with some noted faults of the animal functions, for these kinds of brains, like distorted looking-glasses, do not rightly collect the images of the things nor truly object them to the rational soul. A fever sometimes cures fools and renders them acute. Huarte tells us of a certain man that was a fool at the court of Corduba, who becoming distempered with a malignant fever, came so much to himself that in the midst of disease he spoke with such judgment and discretion that the whole court stood in admiration, *and so remained his whole life afterwards one of the most prudent men of his time.*"

As we cannot believe that Willis embellished this story, we must presume that he took it second hand. He, however, makes an addition of his own experience which is worth recording:—"We ourselves," continues Willis, "have known a certain man of a very blunt Bœotic dull wit, who talks idly, but in fever suddenly brought forth most acute speeches, and seasoned with a great deal of salt and wit. Further we knew a generous old gentleman who, having lost his memory and so the use of discourse, received great help by the distemper of fever happening afterwards."

The great Haller (1708-77*) has also briefly discussed the question of the seat of the soul, for in chapter eleven of his work, *First Lines of Physiology*, he asks, "Is there in the brain any principal part in which resides the origin of all motion, the end of all sensations, and where the soul has its seat? Is it in the corpus callosum?" He comes to the conclusion that it is not, and that this opinion is opposed by very many facts: birds have no corpus callosum, and wounds in that body are not in the least more mortal than those in other parts of the brain, as appears from undoubted experiments.

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* *Primæ Lineæ Physiologiæ.* Gotting., 1751. *Elementa Physiologiæ corporis humani.* Lausanne, 1757-66.

Concerning the seat of the soul, he adds, "We must inquire experimentally. In the first place, it must be in the head, and not in the spinal cord. Again, as it appears from the experiment of convulsions arising when the inmost parts of the brain are irritated, that it lies not in the cortex but in the medulla, and, by a probable conjecture, in the crura of the medulla, the corpora striata, thalami, pons, medulla oblongata. Again, by another not absurd conjecture, where the origin of every nerve lies, as the first origins of all the nerves taken together make up the sensorium commune. Are the sensations of the mind represented here, or do the voluntary and necessary motions arise in that place? This seems very probable; elsewhere he denotes the pons as the probable sensorium commune.

The next author who in chronological order claims our attention with reference to the localisation-theory, is Charles Bonnet (born 1720, died 1793). This celebrated philosophical naturalist starts, like Aristotle and Locke, from the principle that our ideas are derived from the senses; that all the manifestations of our physical life are merely the phenomena of nervous and cerebral action, and that the main object of philosophy consists in the observation of the laws of relation between the function of the central organ of sensation and mental phenomena. It must not, however, be inferred, that Bonnet was a pure sensualist, or materialist. On the contrary, he believed in the continuance of the thinking principle after death, and wrote an apology of Christianity,* which has been translated into most European languages, and was so much admired by Lavater, that he forthwith translated it into German, and challenged Mendelssohn either to refute the arguments, or to embrace Christianity. Bonnet must in so far be considered as an organologist, in as much as he considers not only the brain to be an aggregation of numerous faculties, but assigns special functions to each fibre. Every faculty, sensitive, moral, or intellectual, is in the brain connected to a bundle of fibres. Every faculty has its laws, which subordinate it to other faculties, and determine its mode of action; and not only has every faculty its fasciculus of fibres, but every word has its own fibre.

I feel the more induced to give some lengthy extracts from two of this author's noted works,† because that apart from their intrinsic interest, they bear, as will be seen in the sequel, upon the question of loss of articulate speech, in relation to the intellectual faculties. It will also be found that the theory, propounded by an eminent anthropologist and cephalotomist recently deceased (M. Gratiolet) is here anticipated.

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* *Recherches Philosophiques sur les preuves du Christianisme.* Genève, 1770.

† *La Palingénesie Philosophiqae.* Genève, 1769. *Essai Analytique sur les facultés de l'âme.* Genève, 1770.

Specific Differences of Sensitive Fibres.—Every sense has its own mechanism. Every sense transmits to the soul a multitude of different impressions, followed by as many different sensations. . . . .

Imagination and Memory.—The ideas which objects excite in the mind may be reproduced by imagination and memory. Before searching how an idea may be reproduced, we must know how it is produced.

The Mechanism of Memory.—In order to elucidate a little the mechanism of this wonderful faculty, says Bonnet, he had studied the art we are to impress upon our brain, a sequence of sounds, words, a discourse, and he found that this art, so well-known by public speakers, has for its final object to set the sensitive fibres into a motion corresponding to the order of the sequence of words, to which they are appropriated. These fibres intercommunicate with one another, and may acquire an *habitual* disposition to set each other into motion in a determined and constant order. It is therefore by the repetition of the same movements, in the *same direction*, that we succeed in making these fibres contract this position.

Attention, which adds new force to their movement, aids in fixing the sequence of words on the memory. This sequence is then represented in the brain by a chain of fibres and fibrils, along which the movement is propagated in order, the more constant as the memory is tenacious. Memory is attached to the body, since causes which only affect the body, enfeeble the memory, or destroy it; or may be, fortify it. How many facts in medicine have not established this truth? How many diseases have not been followed by the weakening, or loss of memory? How many accidents have not modified this faculty, or given it more force? The ideas being in their first origin only the movements, impressed by the objects to the sensitive fibres, it follows that the conservation of the ideas by memory, depends on the disposition which the sensitive fibres have acquired to repeat these movements.* I call the *primitive* or *original state* of the sensitive fibres, that which precedes the time when the objects begin to act upon these fibres. The action of objects upon the sensitive fibres, changes to a certain point the *primitive* condition of these fibres, since it imparts to them dispositions they had not before. By dispositions, I always understand determinating to certain movements. The capacity of receiving these determinations, or to express it in a single word, the *mutability* of the fibres lies in their structure. A simple fibre is composed of *molecules*, or *elementary* parts, the form, or the arrangement of which determines the species, or the action of the fibre. If the elementary molecules of the fibres were absolutely incapable of change, the fibres would be rigid, and the objects could make no impression upon them. If the effect which the impression of the objects produce on the fibres were absolutely momentaneous, the impression would not be durable, and there would be no memory. The action of objects upon the fibres *modifies* the original form of their molecules, or changes their *respective* positions. We know nothing of the force which tends to maintain the fibres in their actual condition ; we only know that it exists. Memory requires a certain time to lay hold of objects; this leads to the supposition that there is a resistance to overcome. The phenomena of memory belong to the brain, and the recall of an idea is the reproduction of the movements to which this idea was attached. Every movement involves a change in the body moved. The condition of the brain changes when any object acts upon it. A necessary consequence of this change is that which follows in the state of the mind, and which we express by the names, sensation, perception, idea, &c.

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* *Essai Analytique sur l'âme.*

Extinction of Reminiscences.—The sensitive fibres have been so constructed, that they give to the nourishing particles an arrangement relative to the dispositions they have received; but if, by some foregoing impulse, this arrangement is disturbed, the nourishing particles cannot place themselves with the same regularity, and are no longer in a position for the preservation of *reminiscences*, and the impressions become effaced. Finally, when with the lapse of time, there remain no fibres nor molecules of fibres, which have retained some of these impressions, the memory of them is lost. Too much softness, as well as too great rigidity of the fibres, are injurious to reminiscence.

The celebrated Soemmering (born 1755, died 1830), was about the last anthropologist of note who assigned to the soul a special seat in the encephalon.

"When," says Soemmering, in the introduction to his work *On the Organ of the Soul*,* "during the summer of 1793, after laborious researches touching the human brain, I read, for recreation, Platner's *Questiones Physiologicæ*, and accidentally glanced at the drawings, the result of my researches, the idea suddenly struck me that if the principles laid down by Platner were correct, the *prôton aisthetêrion* must be in the moisture of the ventricles of the brain."

The more, he adds, he studied this subject, the more he became convinced of the probability, not to say the truth of his theory. He could never understand why the *sensorium commune* was assigned to a solid, or rather a rigid portion of the brain (§ 31). As there is no part of the brain which has not been found destroyed without perceptibly interfering with the function of the *sensorium commune*, the latter cannot be limited to a minute solid portion of the brain. If, further, the sensorium commune is in the brain, it must be, as acknowledged by many eminent physiologists (Haller, Albinus, Tiedemann, Platner, etc.), in that part of the brain where all the nerves meet.

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* *Ueber das Organ der Seele von S. Th. Soemmering.* Berlin, 1796.

Now, the cerebral ends, or the origins of *most*, if not *all* the nerves, may be traced to the walls of the ventricles, where they are washed by, or come into contact with the *aqua ventriculorum cerebri*, which fluid he considers as the organ of the *sensorium commune*, or in other words, the seat of the soul. The liquid of the ventricles is therefore the real *medium uniens* of all the nerves, between body and mind. He then discusses the question, whether a fluid can be animated, and answers it in the affirmative, and that there is no valid reason why the liquid of the ventricles should not be organised just as the albumen of the egg. This work, we may add, is dedicated to Kant, the metaphysician.

We have now brought our historical outline of the localisation theory down to the beginning of the present century. In doing so we have given extracts from the writings of some nearly forgotten authors, as well as from classical writers on the functions of the brain. We think that the discussion of a scientific theory is best advanced by tracing the origin of the fundamental idea; by noting the phases through which it has passed, by watching its gradual development, its maturity, its decay, and its likely resuscitation; for an idea once engendered, never dies, it is sure to revive at some period, though perhaps under a different name.

[*To be continued.*]

Anthropological News.

ARCHAIC ANTHROPOLOGY AT PARIS.—The first portion of the Proceedings of the 1867 meeting of the Congrès International d'Anthropologie et d'Archéologie Préhistoriques, held at Paris, has been issued. It contains few papers of any length, the principal being those of M. Arthur Issel, "On Evidences of the Antiquity of Man in Liguria"; Mr. Boyd Dawkins "On the *Pleistocene Mammifera* found associated with human remains in Great Britain"; and of M. Philibert Lalande "On the Megalithic Monuments of